

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 36.

July, 1934.

No. 427.

CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY—NO. CV.

DRABA IN TEMPERATE NORTHEASTERN AMERICA

M. L. FERNALD

(Plates 290–319)

INTRODUCTION

IN the northeastern United States the genus *Draba* is only slightly developed and without taxonomic difficulty; but northeastward, on the Gaspé Peninsula, in western Newfoundland and on the Labrador Peninsula, the genus begins to show some of the diversities and complexities which, in cordilleran North America, Europe, boreal and alpine Asia and the Arctic, render its satisfactory classification most difficult. The recent studies of types of arctic American species by Mrs. Elisabeth Ekman,¹ the studies of Asiatic species by Pohle² and the ostensibly world-wide (but chiefly Eurasian) monograph of *Draba* by O. E. Schulz³ have made it opportune, or at least desirable, to attempt to set our own *Drabas* in order. For her very painstaking

¹ Elisabeth Ekman: *Nomenclature of some North-European Drabae*, Arkiv. f. Bot., xii. no. 7: 1–17, t. 1 (Nov., 1912); *Hvad är Draba hirta L.?*, Bot. Notiser (1913), 183–192 (1913); *Zur Kenntnis der Nordischen Hochgebirgs-Drabae*, Kgl. Svenska Vet.-Akad. Handl. lvii. no. 3: 1–68, tt. 1–3 (1917), ser. 3, ii. no. 7: 1–56, tt. 1–3 (1926); *Studies in the Genus Draba*, Svensk. Bot. Tidskrift, xxiii. 476–495 (1929); *Contribution to the Draba Flora of Greenland*, II, *ibid*, xxiv. 280–297, t. iii (1930); *Contribution, etc.* III, *ibid*, xxv. 465–495, t. v (1931); *Contribution, etc.* IV, *ibid*, xxvi. 431–447 (1932); *Contribution, etc.* V, *ibid*, xxvii. 97–103 (1933); *Contribution, etc.* VI, *ibid*, xxvii. 339–346 (1933).

² R. Pohle, *Drabae asiaticae*, Fedde, Repert. Beiheft, xxxii. 1–225 (1925).

³ O. E. Schulz in Engler, Pflanzenr. iv¹⁰⁵ (1927).

search for the historic type-specimens of the Greenland and other arctic species and for her critical discussions of them we owe gratitude to Mrs. Ekman, who has been able to clarify many formerly obscure situations.

The inherent difficulty of the group, however, coupled, it would seem, with lack of clarity in definition, is peculiarly emphasized by Schulz's treatment. To use his keys, whether to the sections or within the sections, with possibility of arriving at even a doubtfully satisfactory identification, one needs to have had much experience in following down false leads and in successively trying another and another, until eventually some sort of "identification" is achieved. Such misleading and carelessly constructed keys are altogether too familiar in the work of certain Americans; they are not at all confined to European taxonomy, although the sum-total of inadequate and discouraging keys in *Das Pflanzenreich* is disproportionately large. A few illustrations, taken chiefly from species of our eastern American flora, will clearly bring out the inadequacy of these keys.

In the Shickshock Mountains of Gaspé there occurs a densely humifuse and matted, glabrous plant (PLATE 292)¹ with naked, filiform scapes a few centimeters high, which has erroneously passed as *Draba fladnizensis* Wulfen or as the closely related *D. lactea* Adams or *D. fladnizensis*, var. *heterotricha* (Lindbl.) Ball (PLATE 291). The plant is one of four scapose species found (thus far) about the Gulf of St. Lawrence, the others being the well-known stellate-pubescent *D. nivalis* Liljeblad (PLATE 295, FIGS. 1-3), another but apparently undescribed species (PLATE 295, FIGS. 4-7) also with stellate pubescence, as yet known only from a single collection, and the strongly hispid *D. rupestris* R. Br. (PLATE 293), likewise known near the Gulf of St. Lawrence from a single station only. In the present connection the important point to note is, that these plants are normally scapose, only very exceptionally with 1 or 2 small bracteal leaves, the filiform scapes usually only 1-10 cm. high. Consequently, a botanist without uncanny intuition or without special forewarning would inevitably look for them all under the 1st main division of the genus in Schulz's treatment.

A. Caules floriferi aphylli, scapiformes.

But, alas, not one of them, nor the species to which Schulz refers them, is treated by him in the scapiform group! On the contrary, all

¹ This paper being originally published in parts, the plates may not occur in the installments where occasionally cited.

four of the species to which these tiny scapose plants have been referred are found extensively treated under

B. *Caules floriferi ± foliosi.*

This is the more disconcerting since the monographer correctly describes *D. nivalis* with "Caules filiformes, . . . aphylli vel monophylli," *D. rupestris* with "Caules tenuissimi, aphylli vel monophylli" and *D. fladnizensis* with "Caules . . . aphylli vel sub flore imo folio unico praediti"; and in his fig. 28,J he shows the latter with 5 entirely naked scapes and 2 with a bract subtending the lower pedicel; while in his fig. 25,H he correctly illustrates *D. lactea* with absolutely leafless scapes. The only species of our area (in northern Labrador) admitted by Schulz to his "**A.** *Caules floriferi aphylli, scapiformes*" is *D. alpina* L. (PLATE 290); but its very remote segregation in the key from the others is not made clear by the essentially identical descriptive phrase, in the specific treatment, "Caules . . . plerumque aphylli, rarius monophylli." The fundamental trouble, of course, is the altogether too common one of trying to build mutually exclusive keys upon a single inconstant character, without giving warning of exceptions, as a careful systematist would endeavor to do. This reliance upon single inconstant characters is found, also, in the keys to species within the artificially separated sections.

One other illustration, this based on undoubted members of group "**B.**" is illuminating. One of the comparatively frequent species of easternmost Quebec, Newfoundland and Labrador is the biennial *D. incana* L. (PLATE 299), often with excessively leafy flowering stem, the crowded leaves up to 95 in number: "foliis numerosis (usque ad 50 vel etiam ad 95 . . .) valde approximatis"—Schulz, l. c. 285. One would, therefore, promptly key it (Schulz, l. c. 19) to

I. *Caules foliis multis densifolii* . . . Sec. XII. **Phyllodraba**,
a section in which Schulz places our *D. aurea* M. Vahl (PLATE 296), with "Caules . . . crebre (8-16-) foliati" (which is not a very large number) but, also, the Japanese *D. Sakuraii* Makino with "Caules . . . 3-6-phylli," the Colorado *D. crassa* Rydb. (*D. chrysantha* Wats., 1882, not C. Koch, 1847) with "Caules floriferi . . . paucifolii" (the specimens have 1-5 leaves), the Californian *D. corrugata* Wats., well illustrated by Schulz, his fig. 23, showing the few leaves of the primary axis (as in Watson's type) 0.5-1 cm. or more apart (not well described by Schulz's sectional "*Caules foliis multis densifolii*") and, finally, the New Mexican *D. mogollonica*

Greene, with "Folia . . . caulina . . . pauca (1-3), remota"!! But, *D. incana* "foliis numerosis (usque ad 50 vel etiam ad 95 . . .) valde approximatis" is not placed by Schulz in § *Phyllo-draba*. Instead, it is exhaustively treated and over-divided in § XIV. **Leucodraba**, under the call

II. Caules foliis paucis remotis paucifolii.

The preceding instances illustrate the difficulty of interpreting correctly Schulz's sectional groupings of *Draba*, at least those represented in North America. Similar difficulties, most unfortunately, are met in coordinating the specific diagnoses with the key-characters given by him. For example, in sect. *Leucodraba* the key to subsect. *Holarges* (pp. 204-206) is of vast importance to students of the boreal floras. The first division is

a. Siliculae ellipsoideae,

as opposed to

b. Siliculae oblongae vel lineares.

Nevertheless, species covered in the key only under "a. Siliculae ellipsoideae" (nec "oblongae vel lineares") are further defined as follows: *D. hirta*, "Siliculae ex ovato lanceolatae" (p. 204); *D. subamplexicaulis*, "Siliculae . . . oblongae" (p. 273); *D. daurica*, "Siliculae . . . oblongae" (p. 274); *D. arabisans*, "Siliculae . . . lineari-lanceolatae, semper acuminatae" (p. 275); *D. Henneana*, "Siliculae . . . oblongae vel ex ovato oblongae" (p. 276); *D. mongolica*, "Siliculae . . . ovoideae vel anguste lanceolatae, acutae" (p. 278); *D. sachalinensis*, "Siliculae ovato-lanceolatae, . . . ad apicem in stylum . . . attenuatae" (p. 281); *D. incana*, "Siliculae . . . lanceolatae vel oblongae" (p. 283): etc. The inclusion in the key of numerous species as having siliques ellipsoid, as opposed to oblong or linear, and then the further definitions of them as having the siliques oblong, ovoid, lanceolate or linear-lanceolate and acuminate or attenuate (surely not ellipsoid) is such evident contradiction and leads to such inevitable perplexity that one wonders if the many European admirers of Schulz's work have actually faced the problem of using his keys. Schulz's descriptions of species and his bibliography are of remarkably high quality; it is, therefore, the more to be regretted that his keys are so misleading. To some of us, who have long worked in taxonomy, the test of monographic work is the accurate construction of the keys; unless the keys unlock the doors it is impossible to enter.

This extreme difficulty or impossibility of arriving surely at a correct identification by trying to follow the keys in Schulz's monograph is not the only reason for my boldness in attempting to work out some sort of recognizable classification of our *Drabas*. The group is a most interesting element in the more localized or isolated floras of northeastern America and its geographic as well as taxonomic relationships are important to understand. Furthermore, the full content of the *Draba* flora of the temperate latitudes of eastern North America has been most inadequately appreciated. The greatest development of the genus in America is, of course, in the cordilleran region, with the Arctic next; but in the area covered by Gray's *Manual*, thence east to Newfoundland and north across the Labrador Peninsula or south into Georgia, we now know at least 25 true species, and several more are doubtless present.

The utter inadequacy of treatments of *Draba* for the area just defined becomes emphasized when it is noted that in Schulz's monograph ONLY 135 SPECIMENS in the entire genus are cited from the area above defined, and those are largely of the well known annual and biennial species of the South (*D. caroliniana* Walt., *D. cuneifolia* Nutt., *D. brachycarpa* Nutt., etc.). However, in the Gray Herbarium alone (to say nothing of the Canadian National Herbarium, the herbarium of the University of Montreal, the United States National Herbarium, and numerous other large herbaria in the Eastern States, which would more than double the number) the single species, *D. arabisans* Michx., is represented by 154 sheets; while *D. glabella* Pursh (*D. hirta* of most eastern American authors, including *D. Henneana* of Schulz's treatment and *D. daurica* of Mrs. Ekman's) has 137 sheets.

For all of North America (excluding Greenland) Schulz cites only a single atypical (and apparently not conspecific) number (PLATE 303, FIG. 1) from the Gaspé Peninsula to represent *D. norvegica* Gunner (PLATE 301); yet the Gray Herbarium alone exhibits 87 sheets or numbers of *D. norvegica* from Newfoundland and Quebec Labrador! Again, *D. rupestris* R. Br. (PLATE 293) is recognized by Schulz only from Scotland and the Faeröes. Nevertheless, had he done what a monographer of a world-wide genus should be expected to do, namely, visited the larger American herbaria before writing with quasi authority on American plants, the author would have found at the easternmost of the great herbaria (the Gray Herbarium) plants from Newfoundland (PLATE 293, FIG. 2) and Labrador (FIG. 3) which seem quite

inseparable from authentic specimens (FIG. 1) from the type-locality of *D. rupestris*, Ben Lawers in Scotland, except that they are sturdier.

Unfortunately, one can hardly feel that the treatment of *Draba* in *Das Pflanzenreich* shows any more understanding of American plants than has been indicated for other groups by writers of certain treatments in some other volumes in the series. The prevalent European assumption that American plants can be adequately known and understood without visiting and studying the large American herbaria, where the bulk of American specimens are, naturally, preserved and where European visitors would be most cordially welcomed, is one of the greatest fallacies of much Old World taxonomic publication, ostensibly of world-wide scope. It is, I realize, a thankless and unappreciated, if not quite useless task for a mere American to point out weaknesses in the work of some European taxonomists (and other botanists);¹ but, surely, the publications in Europe on American groups would be less open to just criticism if their sponsors would see to it that only the most scholarly work, based upon a truly adequate understanding of the plants and upon ability clearly to present the results, were published. It requires a degree of assurance, which most of us lack, and an opportunity to study extensively in the greater herbaria all over the world, an opportunity which comes to few, properly to prepare the specialist for a monograph of world-wide scope. Such a fortuitous combination of requirements is not common and, perhaps, has never been achieved, but it is certainly not too much to expect that those who undertake cosmopolitan monographs should make some effort to meet these elementary requirements.

Some years prior to the World War, the author of one of the voluminous German monographs (of a genus with 400–500 species in North America) wished, what was obviously out of the question (as wholly crippling work at the lending institution), to borrow many thousands of irreplaceable sheets (including all types) of his assigned group from the Gray Herbarium. Being then a bachelor, with a

¹ The late Charles Baron Clarke, F.R.S., F.L.S., one of the most prolific writers on the *Cyperaceae*, once wrote: "All papers, at least of a systematic kind, prepared in Asia, Africa, or America, must be, as literary work [he omitted to say "as systematic work"], very poor performances in the eyes of botanists in the herbaria of London, Paris, and Geneva [for some reason omitting Berlin]."—C. B. Clarke, *Journ. Linn. Soc. Bot.* xxi. 2 (1884). To one who has some familiarity with *Carex* in North America it is appalling to see how thoroughly the more technical groups of American *Carex* (like the *Ovales*) were misidentified and with what notes of assurance they were mislabelled by Clarke in the herbarium at Kew.

larger proctorial suite of rooms than I needed, I invited my German colleague to spend two or three months in Cambridge as my personal guest. His reply intimated a reason which, unfortunately, limits the possibilities of broad outlook everywhere: "Mit besten Dank bescheinige ich Ihnen den Empfang Ihres Briefes. . . . Lebhaft bedauere ich *vorerst* nicht persönlich Ihre Bekanntschaft in Cambridge machen zu koennen, wir haben in Deutschland Geld für alles, nur nicht für die Wissenschaft."

Even the best of European taxonomic work on groups largely American, conscientiously done by a master of the group, loses much of its implied completeness and authority when, owing to neglect of all except a few continental herbaria, its author fails to study many thousands of American specimens which would clarify his understanding and make his work more truly cosmopolitan. Thus, in Niedenzu's potentially great monograph of the largely American family (seven-eighths American) *Malpighiaceae* there is, as Gleason has already clearly pointed out, "extraordinary and astounding neglect of American material." As Gleason, further, quite justly says, "a visit to America is certainly not too much to expect of the author of a volume for such a dignified and ostensibly authoritative work as the *Pflanzenreich*. . . . Finally, it seems that the present author would be informed and all future authors in the *Pflanzenreich* warned that there are two large herbaria in London and several large herbaria in the Americas, all of which contain much material of importance in the monographing of any group of plants."¹ Dozens (on the average) of American taxonomists annually visit the larger herbaria of Europe for study of types and authentic material. The European taxonomist, one would suppose, would find it absolutely essential to visit the greater American herbaria, if he expects adequately to understand American plants or if he hopes to have his outputtings on American groups respected by American botanists

¹ Gleason, Review of Niedenzu's *Malpighiaceae*, *Torreya*, xxx. 101-103 (1930).

The very natural and human but unfortunate tendency to attempt world-monographs from a wholly provincial viewpoint is not new. The pantropical genus *Smilax* has great development in southeastern Asia (including French Indo-China) and in eastern America. In view of the amazingly important and voluminous collections from these areas accumulated at the Muséum d'Histoire Naturelle in Paris (and elsewhere), the following passage, written in Geneva in 1878, by Alphonse and Casimir DeCandolle is significant: "Les Smilacées ont été l'objet de deux très-bons travaux, . . . Kunth, dans le cinquième volume de son *Enumeratio*, publié en 1850, a décrit très-soigneusement les espèces, du moins celles qu'il voyait dans son herbier, dans celui de Luca ou dans l'herbier royal de Berlin, car il ne mentionne aucune des autres grandes collections, pas même celles de Paris où il a résidé si longtemps."—A. & C. DC., *Mon. Phan.* i. 2 (1878).

as satisfactory world-treatments. By crossing the Atlantic and making use¹ of our important herbaria he would, also, give us an opportunity to reciprocate the many courtesies and attentions we so regularly receive when we visit the Old World botanical centers.

Greater intercourse between the taxonomists of the Old World and the New would do much further to remove or to modify the once disdainful attitude toward American herbaria and botanical publication and the once frequent assumption of finality of botanical knowledge and of its monopoly in limited areas, above referred to. With a less restricted conception of the physiographic, consequently botanical, diversity of regions outside Eurasia the following incident of a not very distant past would hardly recur. A sumptuous Old World monograph of a large boreal genus recognizes but 2 species in Newfoundland, each represented by a single specimen seen. We now know 9 species in that country, represented by nearly 100 numbers in the Gray Herbarium alone. Twenty years after the publication of the monograph I wrote its author, offering to send material of additional species. The reply was: "Ich fürchte dass ich nicht 6-8 Arten aus Newfoundland werde anerkennen können. Ich habe bis heute, obwohl ich viel neues Material in der Hand hatte, keinen Grund gefunden, von dem in meiner Monographie angenommenen Artenumfang abzugehen." If the perfectly frank author here quoted had seen the larger American herbaria, his outlook would have been quite different; at least, he would have had the opportunity for new light.

After openly regretting the weaknesses in the work on American species of the most prolific writer on the *Cruciferae*, it is perhaps unseemly to venture a paper on so difficult a group as *Draba*. It is, however, with full realization of the difficulties but with the hope of at least somewhat clarifying our understanding of our own plants that the present synopsis is presented; only by painstakingly working out the species in natural areas can we attain the proper bases for world-monographs. The lines drawn between species, for instance between *D. rupestris* (PLATE 293) and *D. norvegica* (PLATES 301, 302), when fuller experience justifies, may have to be modified or abolished. In a group where morphological characters of flower and seed are almost wanting and where habit and character of pubescence are more than usually depended upon that is inevitable.

¹ I do not mean to imply that the bulk of specimens in American herbaria can be divided and shared, as one European visitor has repeatedly requested.

The names, likewise, may eventually need some alteration. Without the most intensive understanding of the plants and the most intelligent comparison of adequate series of specimens with the type-specimens, when they can be located, there is constant danger of going astray. In many cases I have been forced, at least for the present, to accept the verdicts of others, especially Mrs. Ekman, Pohle and Schulz, regarding such identities. As pointed out, however, in the discussion of *D. glabella* (PLATES 307-312) Mrs. Ekman recently (1917) asserted with some confidence that the boreal plant which has oftenest (but erroneously) passed as *D. hirta* L. is not that Linnean species, but is a series of boreal subspecies and varieties of the Patagonian *D. magellanica* Lam.; the plants with pubescent siliques being *D. magellanica*, subsp. *cinerea* (Adams) Elis. Ekm. with its var. *dovreensis* (Fries) Elis. Ekm.; those with glabrous siliques *D. magellanica*, subsp. *borea* Elis. Ekm. Very soon, however, she withdrew two of the boreal plants from the Patagonian, her *D. magellanica*, subsp. *cinerea* again (and rightly, it seems to me) becoming (1929) *D. cinerea* Adams (1817) and her *D. magellanica*, subsp. *borea* identified (1930), correctly, with *D. daurica* DC. (1821); but *D. magellanica*, var. *dovreensis* was left unchanged, except that Mrs. Ekman finally considered it a hybrid of *D. daurica* and *D. cinerea*, an origin hardly probable for the true Patagonian *D. magellanica*. Through the generosity of my former student, Mr. J. Francis Macbride, I have a photograph and detailed account of the type of *D. daurica* DC. (1821), PLATE 308, FIG. 3. Through the great kindness of Prof. J. Milbraed, Curator of the Botanical Museum at Berlin-Dahlem, the actual type (PLATE 308, FIG. 2) of *D. Henneana* Schlechtendal (1836) is before me. Through Mrs. Ekman and Dr. Porsild I have many sheets identified by Mrs. Ekman as *D. daurica* (1821) and as *D. magellanica*, var. *borea* (1917). So far as I can make out they are conspecific; but a still earlier name has been overlooked. *D. glabella* Pursh (1814), with an unfortunately misleading name for a plant with stellate pubescence on rosette-leaves, stem, cauline-leaves and sometimes the siliques!, was based on a specimen in the Banks Herbarium, from Hudson Bay. The excellent photograph (PLATE 308, FIG. 1) of it kindly supplied by Mr. Ramsbottom, Keeper of Botany in the British Museum, with detailed notes on all technical characters by his associate, Mr. Exell, leaves no question that *D. glabella* (1814) is conspecific with the others and antedates them all, except *D. magellanica* Lam. (1786), with which I am not convinced that the boreal plants are conspecific.

I have, unhappily, been obliged to point out the inadequacy of certain European work upon the American species of *Draba* and some other groups. Another disconcerting tendency, especially of some Swedish students, is to see hybrids in every plant they do not promptly understand. Floderus, following this wholly hypothetical and very dubious course, has treated nearly all Greenland *Salices* as hybrids. Few representatives of species are found, according to him, in Greenland. It is, consequently, astounding that so many of the Greenland specimens of *Salix* should be inseparable from common plants of the coast of Labrador, northwestern Newfoundland and Gaspé, where at least one of the hypothetical parents assigned by Floderus for the Greenland plants does not occur. Along the same line, Mrs. Ekman has marked a large proportion of the specimens, which she did not understand, in the National Herbarium of Canada as hybrids or probable hybrids of far-distant parents.

As an illustration of this easy but specious method of solving the identity of a plant I may cite no. 1920 of the Canadian National Herbarium, originally distributed as *Draba aurea* M. Vahl, from sand and gravel, Little Charlton Island, James Bay, July 14, 1887, *J. M. Macoun*. The three plants on the sheet at Ottawa are passing from flower to fruit, showing the short and thick, strictly terminal racemes, the long soft pilosity of the $20 \pm$ crowded cauline leaves and the stems, the characteristic retrorse villosity of the silique, the long style (1 mm. long) and the golden petals which at once characterize *D. minganensis* (Victorin) Fernald (PLATES 297, 298), a species with three areas of extreme localization: the Mingan Islands, north of Anticosti; cliffs of Bic, Rimouski Co., Quebec; and limestone islands of James Bay. Yet Mrs. Ekman, not knowing Canadian *Drabas* from field-experience, labels the Little Charlton Island plant "*Draba aurea* M. Vahl, f., potius hybrida: *D. aurea* \times *daurica* (an = *D. arabisans* Michx.)."

The white-flowered *Draba daurica* (i.e. *D. glabella*), with closely pannose-stellate pubescence on leaves and stems and with only 1-5 cauline leaves, and glabrous to sparsely stellate-hirtellous siliques with styles barely 0.5 mm. long (see PLATE 307), occurs in all the areas of *D. minganensis* but its relationship to that species is merely geographic. *D. arabisans* (PLATES 314, 315) is an endemic of eastern North America, with the pubescence of basal foliage and stem minutely stellate-pannose, the 3-12 cauline leaves scattered, the siliques glabrous and the petals white. It has no close relationship to *D.*

minganensis nor has it ever been found either on the Mingan Islands or about James Bay, where it should be expected if it has there produced stable and fully fertile offspring. As for *D. aurea*, that very characteristic species of the North (PLATE 296), is the only one of the three hypothetical parents of Mrs. Ekman's supposed hybrid which is related to *D. minganensis*. It is at once distinguished, however, by the slender and very elongate, leafy-bracted raceme. Furthermore, it is quite unknown about the Gulf of St. Lawrence and, consequently, can hardly have helped give rise to the Mingan and Bic colonies of the very characteristic *D. minganensis*.

Just as this is going to press another of Mrs. Ekman's interpretations of an endemic American species comes to hand. Lest to those who do not know the plants concerned or American geography or who do not check the statements of fact it may seem that I am overstressing the absurdities which the hybridophile will fail to see, I am here quoting Mrs. Ekman's complete statement.

***Draba arabisans* Michx.**

In the year 1911, on my first visit to the Copenhagen Herbarium, the late Professor OSTENFELD had the kindness to show me a specimen of *D. arabisans* Michx. which had been obtained from MICHAUX' countryman, DESFONTAINES, and might possibly be regarded as a second-type. It was not until 1927 that I had an opportunity to see and examine MICHAUX' type in the Musée du Jardin des Plantes in Paris. I then found, that the type-specimen in every respect agreed with DESFONTAINES'S plant and that the two plants probably had once belonged to the same tuft. The stalks of MICHAUX' own type were perhaps a little taller, at least one of them, which was somewhat branched at the top.

When examining the specimens of *D. aurea* in the Copenhagen Herb., in 1931, I was struck by the correspondence which I found to exist between certain of the aforesaid hybridous forms of *D. aurea* and the specimen of *D. arabisans* Michx. donated by DESFONTAINES. Through a microscopical examination of the latter I have been convinced of the identity of this form with the hybrid of *D. aurea* \times *daurica*. To the naked eye the fruits of *D. arabisans* looked glabrous, but under the microscope a few hairs were found in the margin of the valves of some of them. The cruciate hairs on the leaves of *D. arabisans* are shorter and more branched than those of *D. aurea*. The style is shorter than that of *D. aurea* but longer than that of *D. daurica*, the pedicels longer and more spreading than in the latter species and the raceme consequently broader; the pods are slightly twisted. The cauline leaves are of an intermediate number, viz. 6-7 on each stalk, and the stalks are bare between the upper cauline leaf and the lowest pedicel.

MICHAUX' diagnosis is very incomplete, but one characteristic deserves to be remembered, viz. the pointed styles. This may mean that the pods are pointed at the apex, a characteristic which agrees with the pods of both *D. arabisans* and *D. aurea*. *D. arabisans* was collected by MICHAUX

in the Hudson Bay area ("Hudson Strait") and there both *D. aurea* and *D. daurica* are to be found. It is a pity that no distinct proof can be given of the hybridogenity of *D. arabisans*. One has only to study all intermediate forms between *D. aurea* and *D. daurica*, and among them there will probably be found some that agree with the type of *D. arabisans*. Some forms, labelled *D. arabisans* by American botanists, resemble closely *D. daurica*, and are possibly derived from a second crossing, viz. between *D. arabisans* and *D. daurica*. In the specimens found by Messrs A. E. & R. T. PORSILD in 1928 at the Great Bear Lake, the characteristics from *D. aurea* were, however, present, though latent and not obvious.

And finally I only wish to propound: E. GREENE described *D. praealta* with white flowers in Pittonia III (1898), p. 306. In the Manual of Botany of Centr. Rocky Mountains by J. M. COULTER and AVEN NELSON (1909), p. 222 *D. lapilutea* (which according to RYDBERG and SCHULZ is the same plant) is described with yellow flowers. Is this plant possibly also a form of the hybrid of *D. aurea* × *daurica*, of which *D. arabisans* seems to be one? *D. praealta* has been regarded as an annual or biennial plant, but some specimens in the herbaria, for instance no. 22875 in the National Herbarium of Ottawa, which was collected by J. W. BELL in 1900, are obviously perennials.¹

It is most distasteful to be unable always to agree with others; it is most unfortunate that some whom we should like to accept as authoritative students fail to check their own statements and so easily reach important decisions with inadequate understanding of the plants they discuss. Michaux's complete discussion of *Draba arabisans* was as follows:

ARABISANS. *D. caule folioso, simplici vel rarius ramoso: foliis radicalibus cuneato-lanceolatis; caulinis lanceolatis; omnibus acutis: siliculis stylo acuminatis.*

Obs. Affinis *D. incanae*; minus ramosa; racemo fructifero minus elongato: siliculis longioribus: foliis caulinis dissitis.

Hab. in rupibus ripariis ad lacum *Champlain* et in Nova Anglia.

Nevertheless, in a paper on GREENLAND Drabas, Mrs. Ekman states, without a word of qualification, that "*D. arabisans* was collected by Michaux in the Hudson Bay area ('Hudson Strait')." A glance at Michaux's own statement is sufficient to show the complete inaccuracy of this assertion. Lake Champlain, about 125 miles (200 km.) long, separates the states of Vermont and New York, extending slightly into southernmost Quebec. It has an altitude of 96 feet (29.4 m.) and a flora of Alleghenian type, slightly verging on warm-Canadian. Its northernmost shore is MORE THAN 1100 MILES (1770 KM.) SOUTH OF THE NEAREST POINT OF HUDSON STRAIT. Michaux's routes are perfectly well known;² the nearest he ever got to

¹ Elis. Ekman, *Contribution to the Draba Flora of Greenland, VII: Draba arabisans Michx.*, Svensk Bot. Tidskr. xxviii. 79-81 (1934).

² See Journal of André Michaux. 1787-1796, with an Introduction and Notes by Charles Sprague Sargent. Proc. Am. Phil. Soc. xxvi. no. 129 (1889).

Hudson Strait (except possibly in crossing the ocean) was the northern bend of Rupert River, 700 miles (1125 km.) to the south.

Mrs. Ekman's misstatement of the source of the type of *Draba arabisans* and her mistranslation of the very simple diagnostic phrase, "siliculis stylo acuminatis" as "the pointed styles" ("MICHAUX' diagnosis is very complete, but one characteristic deserves to be remembered, viz. the pointed styles") seriously shake a faith which, I had hoped, could be placed in her precision; and her confidence, from study of a single fragmentary specimen, that *D. arabisans* is a hybrid of *D. aurea* and *D. glabella* (*D. daurica*) as seriously disturbs my high estimate of her scientific judgment.

Briefly summarized, the chief diagnostic characters and the geographic ranges of the three plants under discussion are as follows:

D. AUREA: Short-lived perennial (sometimes biennial?), with few basal rosettes; stems simple or rarely forking, very leafy, densely stellate-pubescent and pilose; rosette-leaves canescent-pilose; cauline leaves 7-25, oblong- or ovate-lanceolate, with broad sessile bases, pilose; racemes mostly 10-60-flowered, with the lower 4-12 flowers leafy-bracted, in maturity elongating to $\frac{1}{2}$ - $\frac{4}{5}$ the total height of the plant; sepals pilose; petals golden-yellow; siliques 0.7-2 cm. long, densely pilose, with style 0.5-1.8 mm. long; seeds 30-50, about 1 mm. long. Greenland; northern Labrador; southwestern Ungava (no specimens seen from Hudson Strait); Black Hills and Rocky Mts. See PLATE 296 and MAP 8.

D. GLABELLA, var. TYPICA (D. DAURICA): Suffruticose long-lived perennial, forming extensive mats of rosettes; stems simple or sparsely branched, remotely leafy, minutely stellate-pannose; rosette-leaves minutely stellate-pannose; cauline leaves 0-5, mostly rounded at base, stellate-pilose or glabrate; racemes strictly terminal, long-peduncled, mostly 5-15-flowered and rarely, if ever, elongating to $\frac{1}{2}$ the height of the plant; sepals pilose to glabrous; petals white; siliques glabrous or hirtellous, conspicuously veiny or rugose, 6-13 mm. long, with thick style obsolete or up to 0.5 mm. long; seeds 18-36, 0.7-1 mm. long. Arctic and subarctic regions, south to Newfoundland, Quebec, Lake Champlain (a single known station), New York, and shores of Hudson Bay. See PLATES 307 and 308, and MAP 17.

D. ARABISANS. Suffruticose long-lived perennial, forming extensive mats of rosettes; stems mostly branching, remotely few-leaved, glabrous or sparingly stellate-pannose; rosette-leaves minutely stellate-pannose or glabrate; cauline leaves 3-12, cuneate or but slightly rounded at base, glabrous or stellate-pannose; racemes strictly terminal, long-peduncled, the primary ones 7-25-flowered, in fruit $\frac{1}{5}$ - $\frac{1}{3}$ the height of the plant; sepals glabrous or sparsely hirtellous; petals white; siliques glabrous, lustrous and scarcely veiny, 5-15 mm. long, with slender style 0.5-1 mm. long; seeds 12-36, 1.1-1.7 mm. long. St. Lawrence basin and adjacent northern New England, Newfoundland to the Great Lakes. See PLATES 314 and 315 and MAP 21.

Draba arabisans, familiar to every botanist who knows its type-region, ledges about Lake Champlain, and the dry slates, schists and

limestones of most of the St. Lawrence basin, has so few traits of the arctic and subarctic *D. aurea* that it is almost unbelievable that any one should have imagined that it has any relationship to that short-lived golden-flowered plant, with leafy-bracted, very elongate racemes, numerous pilose leaves, pilose, mostly simple stems and pilose many-seeded siliques. Is it not apparent, if *D. aurea* ever were, by the most improbable long-distance transfer of pollen, a parent of *D. arabisans*, that something of the habit, pubescence, leafiness and color of flower ought to crop out in the "hybrid"? If such a far-fetched explanation were defensible, should not *D. arabisans* show something of the broad-based cauline leaves of *D. aurea* and of *D. glabella*; should it not occasionally have more ovules and seeds (the maximum number in *D. arabisans* and in *D. glabella* or *D. daurica* being near the minimum in *D. aurea*), and if *D. aurea*, with seeds 1 mm. long, should fortuitously cross with *D. glabella* with even smaller seeds (0.7–1 mm. long), why should their "hybrid" have the seeds consistently larger than in either (1.1–1.7 mm. long)? Furthermore, how was the hypothetical cross accomplished? The northernmost station of *D. arabisans* in the East (there, in the neighborhood of *D. glabella*) is 425 miles (684 km.) from the nearest colony of *D. aurea*; its northwesternmost station even more remote (450 miles or 772 km.) from the nearest *D. aurea* and quite as far from the nearest *D. glabella*. It would have required a relay of more than 400 unswerving and consecrated bees to transfer the requisite single pollen grain; bees are often cited as models for humans, but they have not this degree of altruism!

As to Mrs. Ekman's second proposition, that the Rocky Mountain *Draba praealta* Greene is another hybrid of *D. aurea* and *D. glabella* (*D. daurica*), little need be said. *D. praealta* is a winter-annual or very short-lived perennial of the group with *D. nemorosa*. Its northernmost area is more than 1000 miles (1600 km.) from the nearest *D. glabella* and in no character (except in being a *Draba*) does it suggest either *D. aurea* or *D. glabella*. It would be quite as sensible to argue that *D. nemorosa* is a hybrid of *D. aurea* and *D. verna*. No one who did so would be taken seriously.

The above cases in *Draba* and *Salix* are very typical of much of the space-filling guess-work which is too often passing as science, vagaries which suggest that when the hybridophile becomes too obsessed he is in danger of becoming the victim of hybridomania. Of such assumptions in case of *Rubus*, Professor L. H. Bailey thus speaks:

We do not elucidate the blackberry problem by the assumption of miscellaneous hybridity as if the species themselves were known and all the puzzles were mixed progeny: our work takes a new direction the moment we cease to invoke crossing as a way of escape from difficulties. The fact that certain forms are puzzling and of doubtful specific validity does not make them hybrids.

Hybrids there may be, but the first effort is to determine the species which are supposed to spawn into mongrels. Hybridity is to be accepted only on evidence; it can not be determined by the examination of usual herbarium specimens. If sexual mixtures in blackberries are as common and widespread as has been imagined, then the systematology of the group is hopeless, as if hybridity were the order of nature and species were minor phenomena.

From his wide experience with *Rubus* under field conditions, Fernald long ago (*Rhodora* xxii, 185) exposed the danger of easily assuming hybridity. The determination of hybridism in *Rubus* is not so simple and easy as one might suppose: consult, for example, the posthumous resumé of the work of Bengt Lidforss in *Zeitschrift für Induktive Abstammungs und Vererbungslehre*, vol. 12, 1-13, Berlin 1914. Note, also, the studies of Crane and Darlington in *Genetica*, ix, 1927.

It is important that the systematic treatment of *Rubus* in North America be kept simple enough so that others than batologists (blackberry particularists, and they usually do not agree among themselves) may be able to use the information; other ways should be found to record the minor variations and to satisfy the insistent urge to nominalize; otherwise, nomenclature loses its utility.

Perhaps *Rubus* is one of those genera, as Bacigalupi has recently said of *Cuphea* (*Gray Herb. Contr.* xcv.) "whose many technicalities render it particularly fitting that it be left in the hands of a specialist."¹

Along a similar line of reasoning, Professor Einar Du Rietz, discussing the attitude of "the Swedish school of salicologists," says:

if I have not misunderstood FLODERUS' recent papers, many of his species never form pure populations of any extension, those species thus being known only as single individuals or very small populations accidentally found here and there in the highly polymorphic syngameons classed by FLODERUS as hybrids. In those cases it may well be asked whether we are not on a dangerous road that may easily lead to complete dissolution of any practically applicable species-concept in those populations.

This method of treatment, of course, involves the theory that the species distinguished are the primary units and the main population classed as hybrids is younger than those. This, however, is not proved. It appears quite possible that the smaller and more uniform populations classed as species are secondary units differentiated from the highly polymorphic syngameon classed as a complex of hybrids, or even only extreme forms accidentally appearing, disappearing and reappearing within this syngameon. In such a highly polymorphic syngameon any form of sufficient vitality may simulate a primary species if isolated, and to some extent even if not isolated.²

¹ Bailey, *Gentes Herb.* ii. 272, 273 (1932).

² Du Rietz, *Svensk Bot. Tidsk.* xxiv. 381, 382 (1930).

In our *Draba* population of northeastern America hybridization doubtless sometimes occurs, but, just as in most of our groups of vascular plants, the hybrids are quite obvious to those who are familiar with the true species. They do not make up a significant element in the flora, and, being chiefly sterile, they are taxonomically insignificant. The constant and freely fertile plants of definite and highly characteristic ranges surely are not demonstrated hybrids of taxonomically unrelated and geographically remote parents. In groups like *Draba*, mostly dependent on insect-pollination, "absent-treatment" hybrids must be demonstrated before they can be accepted.

In getting at types, some of which have not been discussed by others, I have met with universal kindness and courtesy. The most generous sending by Prof. Milbraed from Berlin of the actual type of *Draba Henneana* Schlechtendal has been noted. Similarly, with his well known liberality Sir William Wright Smith, Director and Regius Professor, has sent me from the Royal Botanic Garden at Edinburgh the type of *D. crassifolia* Graham. Mr. Ramsbottom and Mr. Exell, as noted, have supplied a photograph of and very detailed notes on the type of *D. glabella* Pursh preserved at the British Museum. Dr. Becherer and Mr. Macbride have sent as a gift photographs of and critical notes on four types of species described in DeCandolle's *Systema*. To all these gentlemen I here express my keen appreciation of their courtesies and aid.

In the present study, in which the problems have chiefly concerned plants of eastern Canada, Newfoundland and Labrador, I have been able to supplement the 892 sheets from this area in the Gray Herbarium and the herbarium of the New England Botanical Club with the remarkable collection in the National Herbarium of Canada, a collection made doubly valuable on account of the beautiful material from the shores of Hudson Straits and Hudson Bay secured by the late Dr. Malte and put at my disposal by Dr. R. M. Anderson. I have, furthermore, had the great advantage of receiving as a loan through Brother Marie-Victorin the invaluable collections of specimens of the Province of Quebec belonging to himself and to the University of Montreal. I have also, through the kindness of Drs. Merrill and Gleason, been able to study the material of the New York Botanical Garden and to borrow for closer examination many critical specimens. To all the gentlemen who have thus put irreplaceable collections at my disposal I extend my sincere thanks.

In view of the difficulty of the group and the admittedly tentative classification of it, at certain points, it has seemed important to illustrate very fully the more technical species, especially those which have been misinterpreted. Much obscurity and misunderstanding would have been avoided in the past if proper illustrations had accompanied the original descriptions of all species of the genus. The photographs have been most carefully and generously made by my life-long friend and a co-editor of *RHODORA*, Professor J. FRANKLIN COLLINS, the expenses of the photography and the making of the blocks met in part through the Wyeth Fund of the Division of Biology of Harvard University, in part through the Milton Fund for Research of Harvard University. With his accustomed great generosity and encouragement of accurate illustration, another friend of many years, who has aided me in the collection of many of the cited specimens, Mr. BAYARD LONG, has assumed the entire cost of reproduction of the half-tone blocks.

SYNOPSIS OF *DRABA* IN TEMPERATE EASTERN NORTH AMERICA
(east of the Great Plains and Hudson Bay)

- a. Petals rounded or emarginate at summit: flowering stems with 1 or more leaves above the basal rosette, or, if scapose, with perennial bases, mostly branching caudices and marcescent remnants of old leaves along the caudices below the rosettes. . . . b.
- b. Flowering stem a slender scape (very exceptionally with a basal leaf or bract), including the mature raceme 0.1–1 (rarely –2) dm. high, rising from a basal rosette: rosettes solitary to numerous, at the summits of short crowns or of elongate branches or branchlets of the caudex; leaves of the rosette 0.3–2 cm. long, 1–5 mm. wide: siliques 2.7–9 (very rarely –10) mm. long. (Very exceptional specimens under the next “b” might be sought here). . . . c.
- c. Leaves and scapes bearing simple or elongate and forking (as well as sometimes sessile and stellate) trichomes, or leaves merely ciliate or even glabrous. . . . d.
- d. Leaves conspicuously villous-ciliate: rachis and pedicels copiously villous-hirsute: sepals ovate to rounded-oblong, 1.5–3 mm. broad, villous-hirsute, rarely glabrous: petals yellow, 3.5–5.5 mm. long, 2.5–4 mm. broad: anthers 0.5–0.7 mm. long: seeds 1.3–1.5 mm. long. . . . 1. *D. alpina*.
- d. Leaves stiffly short-ciliate or eciliate: rachis and pedicels glabrous, short-hirtellous or stellate-tomentulose: sepals oblong, 0.5–1.8 mm. broad, glabrous or sparsely short-pubescent: petals white or becoming white in age, 2–5 mm. long, 1–4.5 mm. broad: anthers 0.2–0.5 mm. long: seeds 0.7–1.5 mm. long. . . . e.
- e. Midribs of leaves becoming firm and prominent beneath, persisting as crowded subulate remains

on the multicipital caudices: scapes and pedicels glabrous or essentially so.

Expanding leaves with more or less stellate or furcate pubescence on the surface near the tips: sepals broad-oblong, 1.2–1.8 mm. broad: petals 3.5–5 mm. long, 2–4.5 mm. broad: anthers 0.5 mm. long: siliques oblong to narrowly ovate, 5–10 mm. long, 2–3.5 mm. broad; valves only obscurely or scarcely reticulate; septum without conspicuous median fold: seeds 16–20, often apiculate, 1–1.5 mm. long.

.....2. *D. fladnizensis*, var. *heterotricha*.

Expanding leaves with glabrous surfaces: sepals narrowly oblong, 0.5–1 mm. broad: petals 2–3 mm. long, 1–2 mm. broad: anthers 0.2 mm. long: siliques oblong-lanceolate, 2.7–7 mm. long, 1–2 mm. broad; valves reticulate-veiny; septum with broad median fold: seeds 10–16, rarely apiculate, 0.7–1.1 mm. long.....3. *D. Allenii*.

e. Midribs soft and evanescent: old leaves soon wilting, if persistent remaining as marcescent shreds, not as subulate remnants.

Perennial with multicipital caudex and long-persistent shreds of old leaves: leaves hispid with simple and variously forking trichomes: scape, rachis and pedicels hirtellous with simple or forking trichomes.....4. *D. rupestris*.

Short-lived perennial (sometimes biennial or annual?), with simple or but slightly branching caudex: leaves glabrous, rarely sparsely ciliate: scape, rachis and pedicels glabrous or scape sparsely hirtellous only at base.....5. *D. crassifolia*.

c. Leaves and scapes canescent-pannose with minute stellate trichomes, simple elongate trichomes wanting or very sparse.

Leaves cuneate-obovate to broadly oblanceolate, obtuse: siliques glabrous: style 0.3–0.4 mm. long: seeds 14–28, 0.7–1 mm. long.....6. *D. nivalis*.

Leaves linear or linear-oblanceolate, acute: siliques stellate-hirtellous: style 0.8–1 mm. long: seeds 8–10, 1.2–1.8 mm. long.....7. *D. Peasei*.

b. Flowering stem with 1–many leaves above the basal rosette, 1 cm.–5 dm. high: basal leaves in the perennial species 0.5–9 cm. long, 0.1–1.8 cm. broad: siliques 0.25–2 cm. long. (Very exceptional specimens of nos. 1–7 might be sought here)....f.

f. Perennial, or nos. 8–10 biennial, with often branching caudex, the branches commonly terminating in rosettes of leaves: the biennial often simple-crowned nos. 8–10 very leafy (leaves 7–95) and with racemes often leafy-bracted at base....g.

g. Flowering stem simple or with erect or strongly ascending branches: leaves entire or toothed, rarely lacinate: style many times shorter than the silique, at most 1.8 mm. long: seeds 10–50, 0.7–1.4 (rarely 1.7) mm. long....h.

h. Petals deep yellow (fading in drying): cauline leaves of principal flowering stem 7–25: ovaries and siliques densely pilose; siliques lanceolate to linear-oblong, 0.7–2 cm. long, usually twisted.

- Lower 4–12 flowers of the primary raceme commonly subtended by leafy bracts: pedicels erect, the lowest 5–15 mm. long in fruit. 8. *D. aurea*.
- Lower flowers bractless, the lowermost only rarely subtended: pedicels spreading to arched-ascending, the lowest only 2–4 mm. long in fruit. 9. *D. minganensis*.
- h.* Petals white: cauline leaves 1–95: ovaries and siliques glabrous or variously short-pubescent; siliques linear-lanceolate to ovate or short-oblong, 2.5–12 (rarely–15) mm. long, if strongly twisted and more than 12 mm. long, glabrous or minutely stellate-tomentulose. . . . *i.*
- i.* Biennial (rarely slightly perennial by brief persistence of basal offshoots): lower leaves of the rosettes shriveling soon after anthesis, the rosette-leaves not strongly contrasting with the lower cauline: the subspherical rosette of the 1st year loosening and elongating to form the very leafy (up to 50, rarely to 95, leaves) flowering stem: axis of raceme and pedicels densely pilose-tomentulose to villous with simple or forking hairs or with both intermixed. 10. *D. incana*.
- i.* Perennial, with branches of the caudex usually invested below with fibrous shreds of old leaves: new basal rosettes usually well developed at flowering time; their leaves unlike the cauline foliage: axis of raceme and pedicels glabrous, sparsely hirtellous or stellate-pubescent. . . . *j.*
- j.* Foliage with all or many of its trichomes simple or elongate and irregularly forking, with or without admixed sessile or subsessile regularly stellate hairs. . . . *k.*
- k.* Leaves glabrous except for sparsely ciliate margins, membranaceous, becoming translucent and conspicuously veiny (by transmitted light) in drying: plant otherwise glabrous except for hirtellous sepals: pedicels 4–10 mm. long, the lower nearly equaling the oblong-lanceolate siliques. 11. *D. Sornborgeri*.
- k.* Leaves hirtellous to stellate-pubescent, firm, opaque: stems hirsute at least on the lower internodes: pedicels 0.5–7 (rarely–10) mm. long, mostly much shorter than the elliptic, oblong or lanceolate siliques. . . . *l.*
- l.* Foliage with numerous simple or elongate and furcate trichomes: rosette-leaves linear-oblongate to narrowly spatulate or narrowly obovate, 1–6 mm. broad: mature fruiting stems 0.1–2.5 dm. high, with 1 (rarely 0)–13 (average 6) leaves: sepals 0.4–1.5 mm. broad: petals 3–4.2 mm. long: primary fruiting racemes 1/3–6/7 the full height of the plant: seeds 14–28.
Cauline leaves ovate, 3–10 mm. broad: sepals 1.8–2.6 mm. long, 1–1.5 mm. broad: petals 2–3 mm. broad: siliques oblong or oblong-lanceolate, 2–3.8 mm.

- broad; the lowest on pedicels 1–5 mm. long 12. *D. norvegica.*
- Cauline leaves linear-lanceolate to narrowly ovate, 1.5–6 mm. broad: sepals 1.6–2 mm. long, 0.4–0.9 mm. broad: petals 1–1.5 mm. broad: siliques linear to linear-lanceolate, 2–2.5 mm. broad; the lowest on pedicels 4–10 mm. long. 13. *D. clivicola.*
- l.* Foliage with numerous stellate and several to few simple and elongate trichomes; rosette-leaves cuneate-ob lanceolate, 4–9 mm. broad: mature fruiting stems 1–3.5 dm. high, with (3) 6–25 (average 10) leaves: sepals 1.3–2.3 mm. broad: petals 4.5–5 mm. long: primary fruiting racemes $\frac{1}{4}$ – $\frac{1}{2}$ the full height of the plant: seeds 20–40 14. *D. laurentiana.*
- j.* Foliage with close stellate pubescence forming, at least on the expanding leaves, a pannose coat, simple trichomes wanting or only rarely occurring (except as cilia) on the rosette-leaves *m.*
- m.* Siliques plump, ovoid, ellipsoid or oblong, 2.5–10 mm. long, glabrous: sepals 1.5–2 mm. long, 1 mm. broad: seeds closely but irregularly imbricated, often turned oblique to the septum 15. *D. pycnosperma.*
- m.* Siliques strongly flattened (plump only in no. 18, with densely tomentulose valves), ovate to lanceolate or linear, 5–15 mm. long, glabrous or pubescent: sepals 2–3.5 mm. long, 1–2.3 mm. broad: seeds not imbricated, lying flat against the septum *n.*
- n.* Siliques glabrous or only sparsely hirtellous or scabrous, strongly flattened: racemes usually bractless *o.*
- o.* Cauline leaves mostly rounded at base, oblong, ovate or obovate: mature siliques usually definitely veiny, flat-tish, plane or only slightly twisted: style obsolete or thick and short (up to 0.5 mm. long): fruiting pedicels stoutish, short; the lowest 1–6 (rarely –8) mm. long.
Stems hirsute, especially on lower internodes, with abundant simple divergent trichomes over-topping the stellate hairs: cauline leaves (3) 6–25 (average 10) 14. *D. laurentiana.*
- Stems closely stellate-pannose, sparsely or not at all hirsute on lowest internodes: cauline leaves 1 (rarely 0)–8, rarely–14 (average 4) 16. *D. glabella.*
- o.* Cauline leaves narrowed or only slightly rounded at base, oblanceolate, oblong or narrowly obovate: mature siliques scarcely or only obscurely veiny, often-

- est twisted, sometimes flat, very thin: style slender, 0.5–1 mm. long: fruiting pedicels slender; the lowest 3–15 mm. long: stems glabrous or minutely stellate-pubescent.....17. *D. arabisans*.
- n. Siliques densely stellate-tomentulose, only slightly compressed, hardly flat: racemes usually leafy-bracted at base.....18. *D. lanceolata*.
- g. Flowering stem with strongly divergent branches: leaves lacinate or subpectinate: style filiform, 1.5–3 mm. long, $\frac{1}{4}$ – $\frac{1}{3}$ as long as the spirally twisted stellate-pubescent silique: seeds 7–15, 1.2–1.8 mm. long.....19. *D. ramosissima*.
- f. Annuals, winter-annuals or biennials, with bractless racemes: flowering stems leafy or with at least 1 pair of leaves above the basal rosette....p.
- p. Siliques 1.7–6 mm. long, 6–16-seeded: petals (when developed) 2–3 mm. long: stems simple, or branching nearly to summit, with the numerous small leaves strigose with variously forking trichomes. Stems with abbreviated corymbiform branches from the middle and upper axils: siliques linear-ellipsoid, 4–6 mm. long, minutely stellate-puberulent: seeds 1–1.5 mm. long.....20. *D. aprica*.
- Stems mostly with elongate or leafy branches (or simple): siliques oblong-ellipsoid, 1.7–5 mm. long, glabrous: seeds 0.5–0.8 mm. long.....21. *D. brachycarpa*.
- p. Siliques 5–18 mm. long, 15–80-seeded: petals (when well developed) 2–5 mm. long: stem simple or forking only below, hispid, at least below, like the leaves. Flowers uniform, with yellowish (finally whitish) narrowly cuneate petals about 2 mm. long: leaves scattered nearly to the slender and elongate racemes: siliques 3–13 mm. long.....22. *D. nemorosa*.
- Flowers heteromorphic, some with broad white petals 3.5–5 mm. long, others with reduced petals, others apetalous and cleistogamous: leaves mostly near the base: flowering stems and branches subscapiform: racemes comparatively short and thick: siliques 6–18 mm. long. Leaves obviously dentate, hispid with stipitate and sessile forking trichomes: fruiting raceme elongate, its rachis and pedicels pubescent.23. *D. cuneifolia*.
- Leaves entire or only obscurely dentate, hirsute-ciliate with simple trichomes, stellate-pubescent on the lower surface: fruiting raceme short and umbelliform, its rachis and pedicels glabrous..24. *D. reptans*.
- a. Petals deeply cleft: annuals or winter-annuals: flowering stems naked scapes arising from basal rosettes.....25. *D. verna*.

(To be continued)

PAST PERIODS OF EELGRASS SCARCITY¹

CLARENCE COTTAM

FRAGMENTARY bits of evidence have been obtained which clearly indicate that there have been past periods of eelgrass (*Zostera marina*)

¹ Published with aid to RHODORA from the National Academy of Sciences.